IN THE CLAIMS

Please cancel claims 42-44 without prejudice.

Please amend claims 1-6, 10-15, 19-24, 28-30, 36-41, and 45-47 as follows:

--1. (CURRENTLY AMENDED) A centrifugal separation system comprising:

fluid delivery means ~~to~~ for providinge a cylindrical vortex fluid flow;

a separation chamber ~~to~~ for containing ~~separate unwanted material from~~ said fluid flow; and

a collector ~~to~~ for collecting ~~said separated~~ matter ~~material~~;

C1 wherein said fluid flow centrifugally ejects said matter therefrom into said separation chamber.

2. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1 wherein said fluid delivery means ~~comprises~~ is powered by a motor.

3. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1 wherein said fluid delivery means ~~comprises~~ is powered by an electrical motor.

4. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1 wherein said fluid delivery means ~~comprises~~ is powered by a combustion motor ~~powered by combustion~~.

5. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1 wherein said fluid delivery means is powered by a motor that is powered by compressed gas.

C1 cont

6. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1 wherein said fluid delivery means is powered by a motor that is powered by a flowing fluid.

7. (ORIGINAL) A centrifugal separation system according to claim 1 wherein said separation chamber is cylindrical.

8. (ORIGINAL) A centrifugal separation system according to claim 1 wherein said fluid delivery means comprises an impeller assembly.

9. (ORIGINAL) A centrifugal separation system according to claim 1 wherein said fluid delivery means comprises a centrifugal pump.

10. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1 wherein said fluid delivery means comprises at least one propeller~~s~~.

11. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1, wherein said collector and said separation chamber are configured such that a ~~the~~ pressure is developed in said collector that is greater than the pressure in said separation chamber.

12. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1, wherein said matter is selected from the group consisting of dust, ~~that is capable of separating large objects, such as~~ nails, screws, nuts, dirt, and sand~~, as well as small particles, such as dust and other particulate matter~~.

13. (CURRENTLY AMENDED) A centrifugal separation system according to claim 1 further comprising an inner tube and an outer tube, said inner tube and said outer tube being coaxial and coupled to said separation chamber, wherein the gap between said inner tube and said outer tube form~~ing~~ an annular duct.

14. (CURRENTLY AMENDED) A centrifugal separation system comprising:

fluid delivery means for providing a fluid flow;

a separation chamber for separating matter from said fluid flow;

a collector for collecting said separated matter;

~~A centrifugal separation system according to claim 1 further comprising:~~

an inner tube and an outer tube, said inner tube and outer tube forming an annular duct; and

flow straightening vanes provided within said annular duct to straighten said fluid flow.

15. (CURRENTLY AMENDED) A centrifugal separation system comprising:

fluid delivery means to providinge a fluid flow;

a separation chamber for separating matter from said fluid flow;

a collector for collecting said separated matter;

~~A centrifugal separation system according to claim 1 further comprising~~

an inner tube and an outer tube, said inner tube and said outer tube forming an annular duct, said annular duct ~~and~~ ending in a toroidal vortex nozzle.

16. (ORIGINAL) A centrifugal separation system according to claim 1 wherein said collector is removable for emptying the contents of said collector.

17. (ORIGINAL) A centrifugal separation system according to claim 1 wherein said collector further comprises a door for emptying the contents of said collector.

C1 cont

18. (ORIGINAL) A centrifugal separation system according to claim 1 wherein said collector further comprises a removable stopper for emptying said collector.

19. (CURRENTLY AMENDED) A centrifugal separation system comprising:

fluid delivery means ~~to~~ for providinge a fluid flow;

a separation chamber ~~to~~ for separatinge ~~unwanted material~~ matter from said fluid flow; ~~and~~

a collector ~~to~~ for collecting said matter ~~unwanted materials~~;

an opening in the wall of said ~~centrifugal~~ separation chamber, said opening leading into said ~~dust~~ collector;

an outer tube coupled to said ~~centrifugal~~ separation chamber; and

an inner tube located inside said outer tube, said inner tube and said outer tube being coaxial, wherein the gap between said inner tube and said outer tube forms an annular duct.

20. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19 wherein said fluid delivery means ~~comprises~~ is powered by a motor.

21. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19 wherein said fluid delivery means ~~comprises~~ is powered by an electrical motor.

22. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19 wherein said fluid delivery means ~~comprises~~ is powered by a combustion motor ~~powered by combustion~~.

23. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19 wherein said fluid delivery means is powered by a motor that is powered by a compressed gas.

24. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19 wherein said fluid delivery means is powered by a motor that is powered by a flowing fluid.

C1 cont.

25. (ORIGINAL) A centrifugal separation system according to claim 19 wherein said separation chamber is cylindrical.

26. (ORIGINAL) A centrifugal separation system according to claim 19 wherein said fluid delivery means comprises an impeller assembly.

27. (ORIGINAL) A centrifugal separation system according to claim 19 wherein said fluid delivery means comprises a centrifugal pump.

28. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19, wherein said fluid delivery means comprises at least one propeller~~s~~.

29. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19, wherein said collector and said separation chamber are configured such that a ~~the~~ pressure is developed in said collector that is greater than the pressure in said separation chamber.

30. (CURRENTLY AMENDED) A centrifugal separation system according to claim 19, wherein said matter is selected from the group consisting of dust, ~~centrifugal separation system is capable of collecting large objects, such as~~ nails, screws, nuts, dirt, and sand~~, as well as small particles, such as dust and other particulate matter~~.

31. (ORIGINAL) A centrifugal separation system according to claim 19 further comprising:

flow straightening vanes provided within said annular duct to straighten said fluid flow.

32. (ORIGINAL) A centrifugal separation system according to claim 19 wherein said inner and outer tubes end in a toroidal vortex nozzle.

33. (ORIGINAL) A centrifugal separation system according to claim 19 wherein said collector is removable for emptying the contents of said collector.

C1 cont

34. (ORIGINAL) A centrifugal separation system according to claim 19 wherein said collector further comprises a door for emptying the contents of said collector.

35. (ORIGINAL) A centrifugal separation system according to claim 19 wherein said collector further comprises a removable stopper for emptying said collector.

36. (CURRENTLY AMENDED) A method of centrifugally separating matter from a fluid comprising the steps of:

~~delivering a~~ providing a cylindrical vortex fluid flow ~~to~~ within a separation chamber; and

~~allowing~~ centrifugally ejecting said matter ~~to carry~~ into a collector.

37. (CURRENTLY AMENDED) A method according to claim 36 wherein said fluid flow is delivered to said separation chamber via ~~from~~ an inner tube coupled thereto.

38. (CURRENTLY AMENDED) A method according to claim 36 wherein said fluid flow exits ~~from~~ said separation chamber via an annular duct created between an inner tube and an outer tube, wherein said inner tube ~~being for~~ deliver~~sing~~ said fluid flow to said separation chamber, ~~and an outer tube,~~ and wherein said inner tube and said outer tube ~~being~~ are coaxial.

C1 cont

39. (CURRENTLY AMENDED) A method according to claim 36 further comprising the step of creating a higher pressure in said collector than in said ~~centrifugal~~ separation chamber such that said cylindrical vortex ~~circular~~ fluid flow is maintained without impeding said matter from carrying into said collector.

40. (CURRENTLY AMENDED) A method according to claim 38, ~~36 wherein said fluid flow exits from said centrifugal separation chamber via an annular duct created between an inner tube, said inner tube being for delivering said fluid flow, and an outer tube, said inner tube and said outer tube being coaxial,~~ wherein said annular duct straightens said fluid flow.

41. (CURRENTLY AMENDED) A method according to claim 38, wherein ~~36 further comprising the step of providing concentric inner and outer tubes for delivering and expelling said fluid, said annular duct ending with~~ a toroidal vortex nozzle is located at the distal end of said inner tube and said outer tube.

42. (CANCELLED)

43. (CANCELLED)

44. (CANCELLED)

45. (CURRENTLY AMENDED) A method according to claim 36 wherein ~~said delivering is performed by~~ an impeller provides~~, wherein said impeller performs the step of creating a~~ said cylindrical vortex fluid flow.

46. (CURRENTLY AMENDED) A method according to claim 36 wherein ~~said delivering is performed by~~ at least one propeller provides~~, wherein said propeller performs the step of creating a~~ said cylindrical vortex fluid flow.

47. (CURRENTLY AMENDED) A method according to claim 36 wherein ~~said delivering is performed by~~ a centrifugal pump provides~~, wherein said centrifugal pump performs the step of creating a~~ said cylindrical vortex fluid flow.--

IN THE SPECIFICATION

Please amend the specification on page 21, lines 12-14 as follows:

-- FIG. 16 depicts vertical and horizontal cross sections of ~~an exemplary toroidal vortex bagless vacuum cleaner with a dust collector and circular plan form~~ a centrifugal dust separator in accordance with the preferred embodiment of the present invention.

C2

FIG. 17 depicts an alternative centrifugal dust separator in accordance with the present invention comprising a propeller.--

Please add the following before the paragraph beginning on page 33, line 15:

-- FIG. 17 depicts an alternative centrifugal separator of the present invention similar to that depicted in FIG. 16. However, this separator comprises propeller 1701 in place of impeller 1609. Propeller 1701 is recessed somewhat within inner tube 1702.--

C3

IN THE DRAWINGS

Please add new FIG. 17, attached herewith. No new matter has been added.

REMARKS

Initially, Applicants thank the Examiner for finding allowable matter in claims 14, 15, and 19. Applicants have cancelled claims 42-44 without prejudice. Importantly, Applicants have cancelled no claims for any reasons related to patentability. Applicants reserve the right to prosecute any and all cancelled claims in one or more continuation, continuation-in-part, or divisional applications. Applicants believe that the foregoing amendments and the comments that follow will convince the Examiner that the rejections and objections provided in the December 18, 2002 Office Action have been overcome and should be withdrawn.

I. THE INVENTION

The present invention is generally an improved centrifugal separator capable of separating even fine particulate from a fluid flow. Importantly, this centrifugal separator requires no filters, vacuum bags, or liquid baths because it utilizes a highly efficient fluid flow. Thus, separation performed by the present invention is efficient and low-maintenance.

The preferred embodiment of the present invention utilizes concentric tubing for input and output ducts.

Specifically, an inner tube is coaxially disposed within an outer tube such that fluid may flow into the separator via the inner tube and exit the separator via the annular duct formed between the inner and outer tubes. A toroidal vortex nozzle may be formed at the end of the inner and outer tubes to create a toroidal vortex vacuum system. However, the present invention can be used in any system that requires the separation of matter from fluid flow.

The separation of the present invention occurs in a separation chamber, and the separated matter is collected in a collector located on the side of the separation chamber. Preferably, an impeller is implemented to move fluid flow through the system. In operation, the centrifugal separation proceeds as follows: fluid flow is pulled into the inner tube via suction created by the impeller; the impeller spins the fluid flow (at its blade speed) into a cylindrical vortex; the fluid flow travels along the wall of the separation chamber while matter is centrifugally ejected into the collector; and cleaned fluid flow is expelled out the annular duct between the inner and outer tubes.

Importantly, the present invention has numerous advantages over conventional separation devices in the art. First, the impeller fulfills the dual purpose of providing

the necessary suction and spinning the fluid flow into a cylindrical vortex. Consequently, fluid flow can be spun at extremely high speeds. Also, a pressure exceeding the pressure in the separation chamber is developed inside the collector. This higher pressure helps maintain the cylindrical vortex fluid flow without impeding the matter from being centrifugally ejected into the collector. Because separation is centrifugal, separators of the present invention may operate in any orientation independently of gravity. Additionally, the high speed vortex allows even small particulate to be separated without the use of filters, vacuum bags, or liquid baths that compromise the fluid flow's efficiency. Moreover, only smooth directional changes are made to the fluid flow, allowing for an energy efficient flow design. Consequently, the present invention provides a highly efficient separation system that is simple in design and requires virtually no maintenance.

II. **THE EXAMINER'S OBJECTIONS**

A. OATH/DECLARATION

The Examiner has required an oath or declaration for the subject application.

B. DRAWING REJECTIONS UNDER 37 C.F.R. 1.83(a)

The Examiner has objected to the drawings under 37 C.F.R. 1.83(a) for not showing the propellers in claims 10, 28, and 46.

C. PRIORITY

The Examiner has objected to the "Cross Reference to Other Applications" for indicating that co-pending application Ser. No. 09/835,084, filed 4/13/2001, is a continuation-in-part of application Ser. No. 09/829,416, filed 4/9/2001. The Examiner contends that that the latter application does not belong in the continuity structure of the subject application.

D. CLAIMS

The Examiner objected to claims 5, 6, 11, 12, 23, 24, 29, and 30 under 37 C.F.R. 1.75(c) for being in "improper dependent form for failing to further limit the subject matter of a previous claim." (page 3) Specifically, the Examiner argues that these claims fail to further limit the structure of their respective base claims.

III. **THE EXAMINER'S REJECTIONS**

A. 35 U.S.C. § 112

The Examiner rejected claims 2-4, 12-15, 19-35, 37, and 39 under 35 U.S.C. § 112 as being indefinite. First,

the Examiner argues that the fluid delivery means cannot comprise a motor (claims 2-4 and 19). Furthermore, the Examiner finds the phrase "such as" indefinite (claims 12 and 30). Also, the Examiner requires that "structural connectivity" be indicated for the inner and outer tubes (claims 13-15, and 41). Additionally, the Examiner finds lack of antecedent basis for "said centrifugal separation chamber" (claims 19-35, 39, and 40). The Examiner also finds a lack of antecedent basis for "said annular duct" (claim 41).

B. 35 U.S.C. § 102(b)

Additionally, the Examiner has rejected claims 1-13, 17, 18, and 42-44 under 35 U.S.C. § 102(b) as being anticipated by Crane et al. U.S. Pat. No. 2,192,515 (hereinafter referred to as "Crane"). The Examiner contends that Crane teaches a system comprising a fluid delivery means being a centrifugal impeller assembly, a cylindrical separation chamber, a collector comprising a removable door, and an inner tube and an outer tube forming an annular duct.

The Examiner also rejected claims 36-40 and 45-47 under 35 U.S.C. § 102(b) as being anticipated by Crane. The Examiner submits that:

- Crane teaches a separation method comprising the steps of delivering a fluid flow to a separation chamber and allowing matter to carry into a collector.
- Crane teaches fluid flow being delivered from an inner tube and exiting via an annular duct.
- Crane utilizes a pressure differential between a collector and a separation chamber to maintain circular fluid flow.
- Crane teaches delivering fluid flow with an impeller assembly that creates a cylindrical vortex fluid flow.

Additionally, the Examiner rejected claims 1-7, 9, 11, 12, 16, and 44 under 35 U.S.C. § 102(b) as being anticipated by McKnab U.S. Pat. No. 3,174,264 (hereinafter referred to as "McKnab"). The Examiner claims that McKnab teaches a system comprising a fluid delivery means with a centrifugal pump assembly connected to a motor, a cylindrical separation chamber, and a removable collector.

Further, the Examiner rejected claims 36 and 47 under 35 U.S.C. § 102(b) as being anticipated by McKnab. The Examiner contends that McKnab teaches a separation method including the steps of delivering a fluid flow (with a

centrifugal pump) to a separation chamber and allowing matter to carry into a collector.

The Examiner rejected claims 36 and 39 under 35 U.S.C. § 102(b) as being anticipated by Bauer U.S. Pat. No. 3,426,513 (hereinafter referred to as "Bauer"). The Examiner argues that Bauer teaches a separation method including delivering a fluid flow to a separation chamber and allowing matter to carry into a collector. Additionally, the Examiner contends that Bauer creates a higher pressure in the collector than in the separation chamber.

IV. **THE EXAMINER'S OBJECTIONS AND REJECTIONS SHOULD BE WITHDRAWN**

A. OATH/DECLARATION

The Examiner has stated that the Declaration previously submitted is not an acceptable Declaration for the present application. Applicants have attached a newly executed declaration herewith.

B. DRAWINGS

The Examiner has objected to the drawings under 37 C.F.R. 1.83(a) for not showing the propellers in claims 10, 28, and 46. In response thereto, Applicants have included

propeller 1701 in newly added FIG. 17. No new matter has been added.

C. PRIORITY

The Examiner has objected to the "Cross Reference to Other Applications" for indicating that co-pending application Ser. No. 09/835,084, filed 4/13/2001, is a continuation-in-part of application Ser. No. 09/829,416, filed 4/9/2001. Applicants respectfully submit that U.S. Pat. Publication Pub. No. US 2002/0020035 incorrectly omits application Ser. No. 09/829,416. Application Ser. No. 09/835,084, as filed, includes the aforementioned application (by title only, because a serial number was not yet assigned) in its continuity structure. Therefore, Applicants submit that the continuity structure of the current application is correct.

D. CLAIM OBJECTIONS UNDER 37 C.F.R. 1.75(c)

The Examiner objected to claims 5, 6, 11, 12, 23, 24, 29, and 30 under 37 C.F.R. 1.75(c) for being in "improper dependent form for failing to further limit the subject matter of a previous claim." (page 3) In response thereto, Applicants have amended claims 5, 6, 23, and 24 to teach fluid delivery means powered by various motors. With respect to claim 11 and 29, Applicants have amended these claims to require configuration of the separation chamber

and the collector to create a pressure differential therebetween. Regarding claims 12 and 30, Applicants have amended these claims to more specifically define the term "matter" of their respective base claims.

E. CLAIM REJECTIONS UNDER 35 U.S.C. § 112

The Examiner rejected claims 2-4, 12-15, 19-35, 37, and 39-41 under 35 U.S.C. § 112 as being indefinite. The Examiner rejects claims 2 and 19 for reciting "said fluid delivery means comprises a motor." Applicants believe that the Examiner intended to reject claims 2 and 20 because claim 19 does not contain the Examiner's quoted language while claim 20 does. In response thereto, Applicants have amended claims 2 and 20 to indicate that the fluid delivery means is powered by a motor. With respect to claims 12 and 30, Applicants have eliminated the phrase "such as" from these claims. Regarding claims 13-15, and 41, Applicants have amended these claims to include structural connectivity between the inner tube and the outer tube. With regard to claims 19, 39, and 40, Applicants have amended "said centrifugal separation chamber" to read "said separation chamber" which has antecedent basis in claim 19 and base claim 36. Concerning claim 37, Applicants have added structural connectivity for the inner tube. With regard to claim 41, Applicants have removed "said annular

duct." The remaining claims have been rejected for being dependent on indefinite base claims. Because all base claims have been amended and are no longer indefinite, Applicants submit that claims 21-29 and 31-34 are also no longer indefinite.

F. CLAIM REJECTIONS UNDER 35 U.S.C. § 102(b)

The Examiner has rejected claims 1-13, 17, 18, and 42-44 under 35 U.S.C. § 102(b) as being anticipated by Crane. Claims 42-44 have been cancelled without prejudice.

Applicants direct the Examiner to newly amended claim 1. Crane provides a system that throws dust against a wall of a cylindrical chamber. The dust is then carried downward with airflow until the bottom of the funnel is reached. Next, the airflow is directed upward while the dust falls into the dust collecting chamber. Importantly, Crane utilizes gravity to pull the dust downward into the dust collecting chamber. The present invention, on the other hand, centrifugally ejects matter into a collector. Thus, the removal of matter from fluid flow in the present invention does not necessitate assistance from gravity. As a consequence, separators of the present invention may function in any orientation. Newly amended claim 1 reflects this behavior by indicating that "said fluid flow centrifugally ejects said matter therefrom into said

separation chamber." Crane does not centrifugally eject matter into the dust collecting chamber. Rather, Crane allows dust to drop into the chamber. Thus, claim 1 is not anticipated by Crane. Claims 2-13, 17, and 18 are dependent on claim 1 and consequently, contain all the limitations thereof. Therefore, these claims are also not anticipated by Crane.

Also, the Examiner rejected claims 36-40 and 45-47 under 35 U.S.C. § 102(b) as being anticipated by Crane. Applicants direct the Examiner to newly amended claim 36. As argued *supra,* Crane does not teach centrifugal ejection of matter into the dust collecting chamber. In contrast, newly amended claim 36 includes the step of "centrifugally ejecting said matter into a collector." Thus, Applicants submit that claim 36 is not anticipated by Crane. Claims 37-40 and 45-47 are dependent on claim 36 and consequently, contain all the limitations thereof. Therefore, these claims are also not anticipated by Crane.

Additionally, the Examiner rejected claims 1-7, 9, 11, 12, 16, and 44 under 35 U.S.C. § 102(b) as being anticipated by McKnab. Claim 44 has been cancelled without prejudice. Applicants direct the Examiner to newly amended claim 1. Similar to Crane, McKnab utilizes gravity to separate dirt from airflow. In McKnab, however, airflow is

swirled within a barrel-shaped chamber such that dirt is thrown against the walls. The dirt is then pulled by gravity to the bottom of the chamber. The present invention does not need gravity for separating matter from fluid flow. Rather, matter is centrifugally ejected into a collector as taught in newly amended claim 1. Thus, Applicants respectfully submit that claim 1 is not anticipated by McKnab. Claims 2-7, 9, 11, 12, and 16 are dependent on claim 1 and consequently, contain all the limitations thereof. Therefore, these claims are also not anticipated by McKnab.

The Examiner rejected claims 36 and 47 under 35 U.S.C. § 102(b) as being anticipated by McKnab. Applicants direct the Examiner to newly amended claim 36. As argued *supra*, McKnab does not teach centrifugal ejection of matter into a collector. Newly amended claim 36, however, includes the step of "centrifugally ejecting said matter into a collector." Thus, Applicants submit that claim 36 is not anticipated by McKnab. Claim 47 is dependent on claim 36 and contains all the limitations thereof. Thus, claim 47 is also not anticipated by McKnab.

The Examiner rejected claims 36 and 39 under 35 U.S.C. § 102(b) as being anticipated by Bauer. Applicants direct the Examiner to newly amended claim 36. Like Crane and

McKnab, Bauer teaches a separator that throws particles into the walls of a chamber. However, the particles are not centrifugally ejecting into a collector as taught by newly amended claim 36. Rather, the particles drop into a dust collector chamber with the assistance of gravity. Specifically, particles are pulled by gravity in the axial direction when Bauer's apparatus is vertically oriented. In a horizontal orientation, particles are pulled by gravity into the dust collector chamber. Thus, claim 36 is not anticipated by Bauer. Claim 39 is dependent on claim 36 and consequently, contains all the limitations thereof. Therefore, claim 39 is also not anticipated by Bauer.

In accordance with the Examiner's suggestions, Applicants have rewritten claims 14 and 15 in independent form.

Applicants respectfully submit that neither Crane, McKnab, nor Bauer disclose a higher pressure in a collector than in a separation chamber to maintain a cylindrical vortex fluid flow without impeding matter from carrying into the collector as the Examiner has argued.

In light of the foregoing amendments and remarks, Applicants submit that the specification, drawings, and all pending claims are now in condition for allowance.

CONCLUSION

Applicants submit that all pending claims represent a patentable contribution to the art and are in condition for allowance. Early and favorable action is accordingly solicited.

Respectfully submitted,

Date: 5/29/03

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